SHORT COMMUNICATION

A BREEDING ADVANTAGE TO A PASSERINE LIVING NEAR A PENGUIN COLONY

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SUMMARY

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The black tit (*Petroica macrocephala dannefaerdi*), which is endemic to the Snares Islands, feeds on flies which abound in colonies of Snares crested penguins (*Eudyptes robustus*). Tits breeding near penguin colonies tended to have larger clutch sizes (3 rather than 2 eggs), but they did not begin incubation any earlier than tits nesting further away. Tits living on a peninsula of Main Island where there were no penguin colonies either bred later or had a lower probability of breeding than tits breeding near penguin colonies. Black tits appear to obtain a breeding advantage from feeding in penguin colonies.

KEYWORDS: black tit - *Petroica macrocephala* - Snares Islands - penguins - feeding association.

INTRODUCTION

Associations of small insectivorous birds with other species are well known (Morse 1970, Munn 1984, McLean *et al.* 1987). The reasons for such associations are presumably diverse, although they are thought to involve better access to food and better protection from predators, than for the bird living solitarily (Diamond 1981). In cases where access to food appears to be the primary advantage obtained, insectivorous species often use a 'host' species to flush prey (*eg.* Robinson & Holmes 1982, McLean 1984). Here I document a breeding advantage for an insectivorous passerine resulting from the long-term presence of a host species, rather than its activities.

About 500 pairs of the black tit (*Petroica macrocephala dannefaerdi*) breed on the Snares Islands (Fleming 1950, McLean & Miskelly 1988). Also endemic to the Snares Islands is the Snares crested penguin (*Eudyptes robustus*), which forms dense breeding colonies of up to several hundred nests in forest areas (Warham 1974). Penguin colonies are often in marshy locations, that, when combined with wet subantarctic conditions, guano, and dead penguin chicks and eggs, provide ideal breeding conditions for flies (*Xenocalliphora eudyptis*, *Leptotarsus* sp., *Erioptera* sp.). Black tits are often observed taking flies in penguin colonies, and from around resting Hooker's sealions (*Phocarctos hookeri*).

Black tits are small insectivorous passerines that obtain most of their prey by hawking and gleaning, often from the ground. They appear to be territorial and monogamous. Density on the Snares Islands is high (2.7 pairs/ha) and black tits exhibit many characteristics of island-endemic species, such as small clutch size and a low rate of breeding (McLean & Miskelly 1988).

I hypothesised that tits with nests near to penguin colonies would have larger clutch sizes, and initiate nests earlier, than tits breeding away from penguin colonies.

METHODS

Tits were studied from 7 November to 8 December, 1987, in a 9.6 ha area in the vicinity of the field station on Main Island, the Snares. The study area ranged from 0-50 m in elevation and was

sheltered from the prevailing southwesterly winds. Details of how nests were found and the breeding biology of black tits are in McLean & Miskelly (1988). Black tits have one nest per season, with the peak of laying in early November. Most nests contained eggs when found, although some were located during nest building. All nests were found before hatching, and few chicks had fledged when I left the island.

For each nest, I recorded clutch size and distance to the edge of the nearest penguin colony. Date of beginning incubation was calculated by backdating from hatching using 18-20 days for incubation (Best 1975, McLean & Miskelly 1988).

On 27 November I visited Southwest Promontory, a portion of Main Island which is inaccessible to penguins due to topographical features. The forested area on Southwest Promontory ranges from 50 to 100 m in elevation, and is more exposed to the prevailing winds than the forest in the main study area.

Weather conditions during the expedition were generally fine and warm, with little rainfall and many relatively calm days. Conditions were similar during the three weeks prior to my visit, when many black tit clutches were laid (R. Buckingham & P. Willemse, pers. comm.). Most penguin colonies are sheltered by surrounding forest, and so conditions were excellent for birds feeding on flies within the colonies.

RESULTS

Clutch size and date of beginning incubation were available for 27 of the 29 pairs in the study area. The two excluded pairs were one that began nest building on 11 November but did not lay until early December (15 days later than any other pair), and one pair that had not begun a nest on 7 December.

Four pairs laid two eggs in nests that were 41 ± 21.0 m (mean ± SE) from the nearest penguin colony. Twenty three pairs laid 3 eggs in nests that were 36 ± 5.4 m from the nearest penguin colony. Number of eggs laid was significantly related to distance from the nearest penguin colony (r = 0.35, t = -1.89, one tailed test, $P < 0.05$). This result should be regarded as a trend because of the small sample of clutches of 2.

Incubation began in 2-egg nests between October 31 and November 7, and in 3-egg nests between October 21 and November 27. Date of beginning incubation was not significantly related to distance from penguin colony (r = 0.12, t = 0.58). When date of beginning incubation was added to number of eggs laid in a stepwise regression analysis, the regression coefficient increased slightly but not significantly to 0.40, indicating that there was little effect of date on the relationship between clutch size and proximity of a penguin colony.

By following birds from nests, and by identifying banded birds in penguin colonies, I determined that about one third of black tits in the study area spent at least some time feeding in penguin colonies. Some large penguin colonies had two pairs using them. One penguin colony watched intensively as part of other research was used almost exclusively by a male tit; his mate was rarely seen in the colony.

On 27 November, only three of the nine pairs found on Southwest Promontory were incubating or feeding chicks. In contrast, in the main study area 27 of 29 pairs were incubating or feeding chicks on the same day. This significant difference (X^2 = 11.39, Yates correction applied, $P < 0.01$), suggests that the presence of penguin colonies influences initiation of breeding by all black tits in the vicinity, even though some individuals may not feed in those colonies.

DISCUSSION

These preliminary data suggest that black tits breeding near to penguin colonies laid a larger clutch, but did not begin nesting earlier, than tits breeding further away from penguin colonies. Supplemental food has been shown to influence both clutch size and initiation of breeding in birds (Arcese & Smith 1988). In this case it appears that penguin colonies may be a natural source of supplemental food that tits have learned to exploit. Further research is needed to determine if the availability of penguin colonies influences the social organisation of tits, or the breeding success of tits in poor years, such as during the El Nino summer of 1982/83 when black tit breeding virtually failed (Miskelly 1990).

Although the relationship between clutch size and distance to a penguin colony was significant,

the amount of variance explained was small (12.25%). The unexplained variance is presumably due to variation among tits in factors such as age, experience, fat stores of females prior to laying, and amount of time spent feeding in a penguin colony. Also, black tits that fed on flies clustered around sealions may have obtained an advantage similar to that for feeding in penguin colonies, even though they did not nest near to a penguin colony. Sealions are a more ephemoral resource than penguin colonies and offer a clustering site for flies, rather than a breeding habitat. Thus sealions are less likely to influence the breeding biology of tits than are penguin colonies.

Lack of early breeding on Southwest Promontory may be due to the greater exposure of this location, rather than the absence of penguin colonies (and sealions). However, if a high proportion of tit pairs do not breed at all in exposed locations in some years, or if tits that do not live near penguin colonies have low breeding success, then long term viability of black tits may depend on a much smaller proportion of the population than the current estimate of 500 breeding pairs suggests.

This study suggests that black tits that feed in colonies of Snares crested penguins obtain a breeding advantage. Further data are needed on the extent to which tits feed in penguin colonies prior to egg laying, the extent to which food given to chicks is obtained from penguin colonies, and the breeding success of tits nesting away from penguin colonies. It is not yet known if a larger clutch laid by tits nesting near to penguin colonies results in increased numbers of young raised to independence, or which survive to become breeding adults. However, one extra egg potentially improves the annual breeding success of a pair of tits by 50%.

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